Usability Evaluation for User Interface Design of Student Support System

Mixed Method Study

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Usability Evaluation for User Interface Design of Student Support System: Mixed Method Study

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Abstract. The efficiency of a website depends on how usable the UI user interface, (UI) is and how well it is structured. The aim of this research was to try and understand the issues with the Arion System. Arion is the student information system used by Auckland University of Technology. We conducted three experimental studies to examine the usability and to improve the user experience of student who use Arion. Three main methods were used namely; survey, open card sorting and situated co-inquiry. The survey was used to inform the study and collect more information about users. The open card sorting used to redesign the navigation menu for the system. Then the Situated co-inquiry used to discover the user's current unexpected or unforeseen ideas, which may be helpful for future research.

1. Introduction

The user interface (UI) provides two main interaction points between user and system (the input and the output), which indicate the effects of manipulation by the user [1]. Thus, interface design can be regarded as the "front-end" product, which allows users to interact, communicate, and converse with the machine. Meanwhile, code and data represent the "back-end" product [2].

Usability is one of the main features of an interface assessment. If the UI is difficult to use, it will likely be abandoned by users. Usability can help creating a pleasant and useful UI and is therefore essential throughout the software industry. A user-oriented application design method benefits not only the users, who enjoy a high-quality application, but also the company that produces and maintains the digital products [3].

The target of UI design is a system with high usability [4]. The International Organization for Standardization (9241-11, 1998) defined usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [5].

More simply, Nielsen in [6] defined usability as the quality characteristic that assesses how easy a user interface is to use. The term usability can also refer to the method by which ease-of-use is improved throughout the entire design process [2]. Nielsen in [6] also defines five components of usability: efficiency, learnability, memorability, minimal errors, and satisfaction. By adopting usability concepts, companies can improve their productivity, enhance the quality of their work, increase user satisfaction,

and reduce their support and training costs (ISO/IEC, 2011). 0shows the attributes of usability, based on the views of several researchers.

Table 1: Usability as viewed by several researchers [5-8]

ISO9241-1 1998	Nielsen 1993	Shneiderman 2005	Shackel 2009
Efficiency	Efficiency	Speed of performance	Effectiveness
Effectiveness	Learnability	Time to learn	Learnability
Satisfaction	Memorability	Retention over time	Flexibility
	Errors	Rate of user error	Attitude
	Satisfaction	Subjective satisfaction	

As pointed out by [3], human factors (including efficiency and safe, effective interaction between user and tasks) must be considered when measuring and analysing the usability of any system. According to this description, usability is essential to the development of any system.

Usability testing is a routine test of many web sites to ensure that the site has a friendly interface that makes it easy for users to find what they want [9]. The standards of the International Organization for Standardization for usability testing are effectiveness, efficiency and satisfaction [10].

Arion is a student service and support tool used by Auckland University of Technology (AUT) to Manage correspondence between the organisation and students them and students. Students can use Arion to read correspondence from Arion, pay fees, lookup papers and grade, and look up their timetable as shown in figure 1. Informal discussion with some students revealed they struggle of using the Arion system. Also, four of the researcher in this study doing a postgraduate and using the Arion and face some issue.

The academic website often does not do justify to the user experiences who navigate the website[11]. User depends on the website menu (hyperlink) as an overall map structure for the website[12]. Therefore, they need to be labelled in such an easy way to understand and organise in an ideal way to follow user mental model[11]. Therefore this study is to identify problems with the information architecture and the information discoverability of Arion.

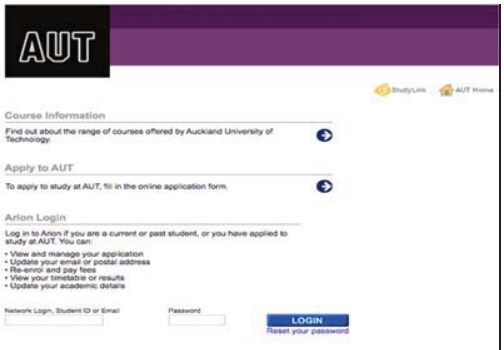

Figure 1: Arion system.

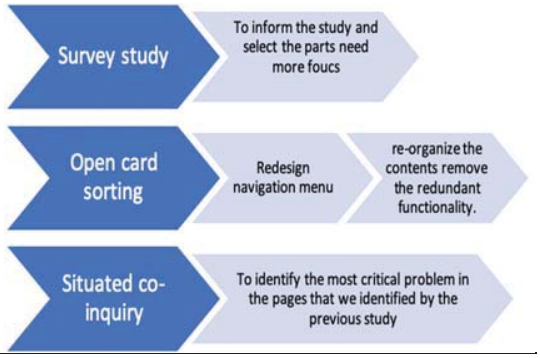

Figure 2: Methods and aims of all studies.

In the next section, we will present the study methods of our research. Each of our studies is then presented and the results of each are discussed.

2. Study Methods

To find relevant user tasks for the usability test, we wanted to identify the areas of Arion that were the primary use for most people and the areas that had the most problems. This way, we would be able to formulate recommendations that not only addresses actual issues, but that would also improve the user experience for most people. To do this, we created an enquiry.

Three main methods were used in this study to enhance the depth of the system evaluation and support the methodological triangulation to increase the validity and reliability of the finding as shown in figure 2. Mixed method approach allowed to a more comprehensive understanding of participants experience and enable the identification of usability issues [13].

The first method used was the survey. We conducted a survey using Google Survey. In order to understand more about the problems and issues that the users face while using Arion. Google Forms was used as it is free and easy to use the tool. 0shows our study aims; the survey study was used to help to know which areas of Arion require our attention. In addition, this also provided us with useful information about the end users.

Following, we used open card sorting to redesign the navigation menu and re-organize the contents by removing the redundant functionality. The card sorting was used before the situated co-inquiry to prevent the user from knowing or using the original navigation menu while they are searching for timetables or running a paper search, as these might create a short-term memory for users and affect the outcome of the card sorting.

In total, 146 participants responded to the survey. The participants who took the survey were aged between 18 and 37, with a mean age of 24.6. 37% of the participants were men, while 60.9% identified as women. Many of the participants had only used Arion for less than a year (69.6%).

Additionally, 78.26% of the participants had not used a similar system in the past, so the target group were relatively inexperienced. People who had used similar systems pointed to systems such as Moodle, Massey Portal, and Gateway - most of which were referred to as being more user-friendly than Arion. The majority of users also did not log into Arion that often, 58.7% only logged in once a week and another 37% logged in a couple of times a week. Their reason for logging in was often to check their timetable or their grades.

We have formulated a primary goal of the usability testing order to fix the problem with navigating the website and for finding the information we have set up an open card sorting test to answer the following question 'how can the navigation of the Arion website be improved to increase discoverability?'

Additionally, we have formulated a secondary goal that we hope to address using the situated co-inquiry and the prepared user tasks in order to understand how can information be presented to the user to make Arion a more enjoyable experience?

2.1. Survey Study

The survey consisted of two main sections; the purpose of the first section was to gather demographic data about our participants. We asked the participants about their age, gender, and for how long they have used Arion, and additionally, if they had used similar systems before. This gave us an understanding of who our user group is. Due to us being temporarily unable to determine the direct relationship between the user experience and these factors we will retain this data for reference later in the design of usability tasks and for analysis purposes.

The purpose of the second section of the survey was to find the most used areas of the system and the areas that people found to be less user friendly. To do this, we used both Likert scales and qualitative text fields. We were concerned about how people would remember their experience, depending on whether their experience of using the system was successful, as people tend to remember either the peaks of or the last part of an experience, as described by the peak-end [14]. We were not really concerned with whether participants were successful, as the whole process of completing an action is more critical. Achieving a goal after five seconds with no problems is vastly different from doing so after five minutes with a lot of frustration. In order to counter this problem, this section of the questionnaire/survey begun with a disclaimer about how to answer the following questions. The disclaimer can be seen below.

"Please answer the questions as accurately and fully as possible. Please do not base your answers on whether you were [successful], but how the experience was overall (was it annoying, troublesome, tiring, pleasant, easy, etc.)."

The results demonstrated that users have an issue with the timetable and paper search functionalities that were existing in the Arion website.

2.2. Open card sorting Study

The second study was open card sorting. Six users participated in this study all of the students at AUT aged between 18-35. In open card sorting study, we had the option of either allowing the participants to work individually or in pairs, as each presented us with advantages and disadvantages. If we used individual participants, we would have more data to compare and analyse, but we would potentially have had to interrupt participants in order to encourage them to think aloud. Allowing the participants to work in pairs helped the discussion to develop naturally, and the think-aloud technique is a natural part of talking and deliberating with a partner.

Before the participants entered the testing room, the cards were arranged in random order on the table in front of two chairs, so as not to create any bias or connection between cards from the get-go. When the participants entered the test was introduced and explained to them. Participants were told to sort the cards into natural and intuitive categories and give these categories names. Additionally, they were told that nothing they did would be considered wrong and that we were testing Arion and not them.
The testing was passive, meaning that we did not take an active role in the test.

The data was analysed using the method adopted by [15] in which we created an Excel document with the categories on the first row and the cards on the first column. The classes consisted of the most common categories created by users, as well as standard terms for similar categories that the participants had named differently; for example, two pairs of users had put same cards into groups called “Interaction” and “Help”, so these were counted into one category called “Help”. After that, we created a heat map of the data to see in which category cards most often appeared and then we grouped the most common occurrences together.

There were a number of submenu item cards that all three pairs of participants categorised differently, making it difficult to sort these cards into categories based on the user feedback. There could be several reasons for this.

Firstly, the number of participants for this test were very few and the number of data points even lower. According to Wood and Wood in [16] the general consensus is the more participants involved, the better. However, 25-30 participants are considered to be enough if these participants are representative of the group, as this is likely to yield the same results as several hundred participants.

Secondly, it is possible that the cards were named too ambiguously for the participants to be able to sort them into appropriate categories. This happened with the tags “Secondary education” and “Tertiary education”, where some participants upon seeing the tag name associated this with signing up for different kinds of educational courses at these levels. These participants stated that they did not believe this was suitable for a university website. In actual fact, a tag name was related to the user’s profile and their previous education. This was also utilised with the cards “Course by [...]” which initially just said “By faculty”, “By specialisation”, etc. It was deemed that these were too contextual for the top menu item they were in, and the participants expressed the same view after the test, where they said that they would have sorted differently if they knew. In any case, these results can also be used to improve the naming of some of the submenus.

Certain cards were consistently put into the same categories, and this can be seen in the table above. The tickets that were not sorted systematically because of the reasons stated above, should still have been sorted by us into appropriate categories. For example, the find papers “By [...]” classes should be in course information, even though our participants placed them all over the place.

Some cards were grouped into subcategories of higher-level architecture. For example, one pair of participants created a finances category which they put into an “Account” category. They thought that these finances should be connected to the user account in some way, but that they were also two distinct categories. It was also a common theme for many of the “Redundant”- category cards, that participant did not know where to put such a menu item. In this category, some participants placed the find papers “By [...]”-cards, the “Graduation application”, “Downloadable forms” and more. These cards could be sub-sections of other cards instead of being classed separately, cluttering the information architecture and making the search less intuitive.

2.3. Situated Co-Inquiry Study

Situated Co-Inquiry is described by Carter in [17] as a participatory talk aloud approach at the centre of a user's or participant's experience in a way that is harmonious with their cognitive and affective consciousness at play at that moment.

To ensure the diversity of data collected, we used the survey data above to identify the ideal test users to make sure they are representative of one group of users. Also, the characteristics of different user groups are distributed as shown in table 2. Please note that we use pseudonyms for our testers here to protect their privacy.

Table 2: Participant's information.

ID	Age	Ethnicity	Years of use of Arion	Other systems they have used
User 1	25	European	2 months	Moodle, Lectio
User 2	27	European	2 months	Moodle
User 3	30	Chinese	1 year	N/a
User 4	23	Chinese	2 years	N/a
User 5	24	Indian	8 months	N/a
User 6	35	Indian	9 months	N/a

The researchers started the session by introducing themselves, and all participants were fully informed about the process and purpose of each session. There was no deceit or intimidation involved and participants could withdraw from the study at any time before their data were analysed.

As such, we encouraged the participants to talk-aloud while performing formulated user tasks. The participants would be reminded to do this throughout the test in case they forgot to do it. There were three user tasks as shown in Table 3.

Table 3: Testing tasks

Section	Task#	Task Description
Timetable	1	a. You have been enjoying your semester break, but now it is soon over. You need to know when you start having classes again. Find the first class after the semester break.
	2	b. To make sure you don't miss anything after having much time off, you want to know when all your September classes are. Show us all your courses in September.
Paper information	3	You are a postgraduate student looking for papers about writing journalism to enrol in Semester 2, 2019. Find an article that is relevant to you.

During the testing session, the facilitator would ask the participant to pause in order to clarify certain points. In relation to this, the facilitator and participant discussed various problems or communications during the situated co-inquiry in order to find common ground or even solutions to problems encountered.

The experiments session were placed at AUT campus was used so the participant will be familiar with the room. Two cameras were recording during the test to ensure that the test results and data were saved. One camera was used to record the user's expressions and gestures, and the other to document the process of operating the Arion interface, we also used Windows screen recording for backup. The audio recorder allows us to analyse the user's think-aloud responses repeatedly. By playing back the video, we were also able to record the time required for each user to complete individual steps during the test. From doing this we were also able to analyse how efficient the test was.

Each person participating in the trial was equipped with a logger that could observe the tester's behaviour and what was said. These findings were then recorded in the logbook. Moreover, at the end of the survey to express our gratitude to the participants, we provided them with each with a cookie.

All users completed the task, even though we observed many users with nervous expressions. There were also a number of complaints which we logged in the logbook.

Through the sessions, we identified several problems that we would like to address. For example during the test, we noticed that the users were mostly accustomed to browsing the screen from top to bottom. The navigation should always be at the top of the screen so that it is more accessible to the user. This is in line with what Williams et al, in [18] recommends. That is, the longer the distance and the smaller the size of the target, the longer the operation takes. As we see users complain that the font in the user interface is too small, we recommend increasing the size of the buttons and fonts in the navigation menu and positioning the navigation at the top. The time it takes for the user to move from the edge of the screen to the navigation menu is minimised.

The user is usually not guided during the process of using the system, and the user does not follow a set of procedures to learn and become familiar with the system. Conversely, a pleasant environment can be established by supporting exploratory interaction, and users will learn by themselves [19]. For example, we found that in using the graphical timetable, User 4 found that he/she could display consecutive days of courses by dragging and selecting.

What is surprising is that users with experience using other similar systems, spend more time in the first timetable task, and can quickly find a course on a specific date through text timetable.

The graphical timetable uses interactive data visualisation, which in theory should help users increase decision making speed [20]. Unfortunately, in our test results, it shows that most users do not tend to use a graphical timetable.

Interestingly, the user believes that the corresponding results can be displayed through some clickable content. However, if the clickable content cannot be clicked or does not show any changes, the user will no longer trust the design of the interface. For example, user 3 clicks on the “June” label multiple times and wants to display the entire courses through June, but the corresponding timetable has not changed. The ambiguity of a title or repetition of categories in a different heading tab of a menu can cause confusion for the user, for example, “course info” and “programme info”. We see that when user 1 browses through the navigation and finds paper search, the user's misunderstanding of the title prompts the user to spend more time searching. When design deviates from standards and practices, users often take longer to think about or get auxiliary information from other factors. This will cause user emotionalisation to be very detrimental to the user experience [21]. This is a common problem in human-computer interaction. The best way to solve the challenge is to unify the standard so that the user only needs less time to react.

3. Discussion and Conclusion

The study aimed to improve the UI design for the Arion system with the help of three main usability testing methods to see how these could improve the user experience result.

The first method was the survey which helps to indemnify the issue, collect more data about end users in addition to more understanding the problems.

The second method was Open card sorting. The aim of using this was to try and improve the navigation structure of the website. Through the Open card sorting Study, we found that all three groups of users were confused about how labels are classified. Moreover, it was found that each of the user groups had different thoughts and opinions about the existing navigation menu of the Arion system. These results are in line with those of previous studies by Wang & Yen in [22] which found the web structure needs to be simple, clear and make the features easy to find.

The third method was the Situated Co-Inquiry which has been used to find the most critical problem in the pages, in addition, to help us to give the suggestion for the designers such as Appropriately add image information to the page, and the appropriate image can attract the user's attention Schmidt, Liu, & Sridharan [23], and can increase the aesthetics of the page [24].

This study has identified several issues with the Arion system as we mentioned in the previous sections. The purpose of our study is not only to point out the issues with Arion UI but to also provide some solutions. Therefore, the usability report was handed to the design team at AUT in order to improve the user experience for the Arion system.

From the analysis of the results, we discovered that although all users have completed the tasks we set, the less experienced users are less efficient in the way that they operate the system. The current interface is not conducive in allowing users to explore and self-learn, and it is a challenge for students

to complete to use. Through the students' reaction, we can see that most people have various opinions on the system; that is, they are dissatisfied with the discoverability of the system architecture and interface. Users feel that there are too many options available in the Arion website and some of them are redundant. Overall, we concluded that Arion could be redesigned in order to create a system that is more efficient and user-friendly.

References

[1] El-Bakry H M *et al* 2010 Adaptive User Interface for Web Applications *Recent Advances in Business Administration: Proc. of the 4th WSEAS Int. Conf. on Business Administration (ICBA'10)* pp 20-2
[2] Galitz W O 2007 *The essential guide to user interface design: an introduction to GUI design principles and techniques* (New Jersey: John Wiley & Sons, Inc)
[3] Sharp H, Rogers Y and Preece J 2007 *Interaction design: beyond human-computer interaction* (Chichester: Wiley)
[4] Rubin J and Chisnell D 2008 *Handbook of usability testing: howto plan, design, and conduct effective tests* (New Jersey: John Wiley & Sons, Inc)
[5] ISO9241-11 1998 *Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11 : Guidance on usability* Available: http://www.it.uu.se/edu/course/homepage/acsd/vt09/ISO9241part11.pdf
[6] Nielsen J 1993 *Usability engineering* (Amsterdam: Elsevier)
[7] Shneiderman B and Plaisant C 2005 *Designing the user interface* 4th edition (USA: Pearson Addison Wesley)
[8] Shackel B 2009 Usability–Context, framework, definition, design and evaluation *Interacting with Computers* vol **21** no 5-6 pp 339-46
[9] Battleson B, Booth A and Weintrop J 2001 Usability testing of an academic library web site: a case study *The J. of academic librarianship* vol **27** no 3 pp 188-98
[10] Kortum P and Sorber M 2015 Measuring the usability of mobile applications for phones and tablets *Int. J. of Human-Computer Interaction* vol **31** no 8 pp 518-29
[11] Silvis I M, Bothma T J and de Beer K J 2018 Evaluating the usability of the information architecture of academic library websites *Library Hi Tech*
[12] Sundt A and Eastman T 2019 Informing Website Navigation Design with Team-Based Card Sorting *J. of Web Librarianship* vol **13** no 1 pp 37-60
[13] Abowitz D A and Toole T M 2009 Mixed method research: Fundamental issues of design, validity, and reliability in construction research *J. of Construction Engineering and Management* vol **136** no 1 pp 108-16
[14] Chajut E, Caspi A, Chen R, Hod M and Ariely D 2014 In pain thou shalt bring forth children: The peak-and-end rule in recall of labor pain *Psychological science* vol **25** no 12 pp 2266-71
[15] Ma S 2010 *Dancing with the Cards: Quick-and-Dirty Analysis of Card-Sorting Data* Available: https://www.uxmatters.com/mt/archives/2010/09/dancing-with-the-cards-quick-and-dirty-analysis-of-card-sorting-data.php
[16] Wood J R and Wood L E 2008 Card sorting: current practices and beyond *J. of Usability Studies* vol **4** no 1 pp 1-6
[17] Carter P 2007 Liberating usability testing *Interactions* vol **14** no 2 pp 18-22
[18] Williams K, Clarke T, Gardiner S, Zimmerman J and Tomasic A 2019 Find and Seek: Assessing the Impact of Table Navigation on Information Look-up with a Screen Reader *ACM Transactions on Accessible Computing (TACCESS)* vol **12** no 3 p 11
[19] Sharp H, Preece J and Rogers Y 2019 *Interaction design: beyond human-computer interaction* (New Jersey: John Wiley & Sons, Inc)
[20] Few S 2013 Data visualization for human perception *The Encyclopedia of Human-Computer Interaction* 2nd Edition (Aarhus: Interaction design foundation)
[21] Wong E 2019 *Principle of Consistency and Standards in User Interface Design* Retrieved from https://www.interaction-design.org/literature/article/principle-of-consistency-and-standards-in-user-interface-design

[22] Wang M and Yen B 2007 Web structure reorganization to improve web navigation efficiency *PACIS 2007 Proceedings* p 46
[23] Schmidt K E, Liu Y and Sridharan S 2009 Webpage aesthetics, performance and usability: Design variables and their effects *Ergonomics* vol **52** no 6 pp 631-43
[24] Stone R W, Baker-Eveleth L J and Eveleth D M 2018 The Role of Aesthetics Influencing User Satisfaction with Recruitment Websites *Int. J. of Humanities and Social Sciences* vol **10** no 1 pp 76-92